

## **Qualitative Benefits of New Sources Categories Available through CAP Incentives Guidelines**

Senate Bill 856 allows the California Air Resources Board (CARB) to incentivize and replace stationary source equipment that is not subject to the Cap-and-Trade Program. Replacing these sources of air pollution will further reductions of toxic air contaminants (TACs) and criteria air pollutants.

The new source category projects can be found in the Community Air Protection Incentive 2019 Guidelines (Guidelines), which were approved by the California Air Resources Board (CARB or Board) in May 2019. The Guidelines add chromium plating, chromic acid anodizing facilities, and projects to reduce air pollution at schools as funding options. These funding categories will use a qualitative methodology for reporting projects funded X and Y to describe the pollutants mitigated. CARB will also develop and provide directions for any stationary sources that are identified in the future.

The following interim qualitative approach will be used until CARB staff develops a quantitative methodology for emission and exposure reductions. Project analysis will consist of a description showing that the project funded will provide the co-benefits of air pollutant exposure reductions.

### **1. Hexavalent chromium**

The Board identified hexavalent chromium as a TAC in 1986, and it is now identified as the second most potent carcinogen. There are approximately 150 chrome plating and chromic acid anodizing facilities that use hexavalent chromium and currently operate in California. Communities identified by the Board for AB617 Community Emission Reduction Programs had significant hexavalent chromium emissions according to emissions data from the 2016 California Emission Inventory Development and Reporting System. Although there is a statewide Hexavalent Chromium Airborne Toxic Control Measure for Chrome Plating and Chromic Acid Anodizing Operations (title 17, CCR, § 93102) (Chromium Plating ATCM), there are technologies and chemical substitutions that can reduce emissions beyond what is required.

Hexavalent chromium plating's electrolytic process forms a hexavalent chromium mist that is released into the air and can be inhaled. There are also non-electrolytic process tanks that can contain and emit hexavalent chromium because of pre- or post-plating steps such as stripping, rinsing, or sealing. Prolonged exposure to hexavalent chromium can cause lung cancer and other non-cancer health effects.

The Chromium Plating ATCM controls hexavalent chromium emissions by requiring the use of either chemical fume suppressants or add-on control technology to meet an emission limit. Facilities, especially those close to sensitive receptors and AB 617 communities, could further reduce their hexavalent chromium emissions past what is required through the use of permanent total enclosures (PTE) and HEPA add-on pollution control (APC) systems. These options and other technologies can provide reductions that are in excess of those otherwise required by federal, State, and local rules and regulations.

Another way facilities can eliminate hexavalent chromium in the plating process is by utilizing market available trivalent chromium plating bath solutions. This alternative also significantly reduces the potential health impacts to nearby communities. Therefore, conversion to trivalent chromium plating is the preferred control option for decorative chrome plating operations. It is important to note that trivalent chromium plating operations are not exempt from the requirements under the Chromium Plating ATCM. Currently, facilities using trivalent chromium plating can employ either a wetting agent as a bath ingredient or can meet an emissions limit for total chromium through the use of various air pollution control options.

## **2. Reducing Air Pollution in Schools**

### **a) Air filtration**

Numerous epidemiological studies report adverse respiratory health effects from exposure to ambient pollutants particularly for sensitive groups such as children<sup>1-8</sup>. The primary pollutant of concern is particulate matter (PM), especially particles that are 2.5 um in diameter or smaller (PM<sub>2.5</sub>). Inhaling this size fraction of PM is linked to a number of adverse health outcomes in children, particularly asthma. Studies show that children living in low-income, disadvantaged communities are more likely to suffer and miss school because of asthma.<sup>9</sup> Implementing air filtration devices will help reduce the cumulative effect of PM<sub>2.5</sub> exposure and improve human health.

The average student spends approximately 25% of their day inside a classroom. This means annually, about 12% of a student's time is spent in a classroom. Due to their time spent inside, indoor levels of air pollution can greatly impact the health of young students. Indoor air pollution occurs from indoor sources as well as outdoor pollutants that are carried into the structure<sup>10-15</sup>. Air filtration systems can be upgraded to reduce indoor concentrations of particle matter by increasing the efficiency of the filters use, or by increasing the volume of air filtered. Both stand-alone<sup>16-21</sup> and high efficiency panel filters installed in the central system<sup>22, 23</sup> have been shown to reduce indoor particle concentrations.

Although major health impacts can result from cumulative exposure to PM<sub>2.5</sub> inside and outside the classroom, installing enhanced filtration in schools will help reduce exposure and provide cleaner air while in the classroom.

Epidemiological based studies have not yet found a direct association of health benefits with increased filtration in schools and homes. However, there are numerous studies which model possible health benefits based on the estimated cumulative reduction of PM<sub>2.5</sub> exposures in classrooms from enhanced filtration. A recent study estimated that upgrading the filtration in classrooms from MERV 5 to MERV 14 would reduce the indoor to outdoor ratio of PM<sub>2.5</sub> in classrooms from 0.86 to 0.15. Upgraded filters can also reduce the number of asthma symptom-days<sup>24</sup>. Another recent study funded by CARB found that enhancing air filtration in the home can produce measurable results especially for asthmatic children<sup>25</sup>. Installation of stand-alone air cleaners and high-efficiency filters in a central system improved indoor air quality across all particle size fractions, with the greatest improvements in the smaller size fractions. For severe asthmatics, the studies show a small but statistically significant reduction in the numbers of visits to clinics. Sleep quality also improved because of reduced waking due to asthma symptoms.

#### **b) Composite Wood**

The California Air Resources Board (CARB) identified formaldehyde as a toxic air contaminant (TAC) in March 1992. Composite wood products are a major source of the chemical since they are often manufactured with glues that contain formaldehyde. These glues undergo chemical degradation and release unreacted formaldehyde fumes which can then be inhaled.

The airborne toxic control measure (ATCM), adopted by CARB in April of 2007, aimed to reduce formaldehyde emissions from composite wood products that are sold, supplied, used, or manufactured for sale in California. The ATCM specifically focuses on three types of composite wood products: hardwood plywood (HWPW), particleboard (PB), and medium density fiberboard (MDF). HWPW, PB, and MDF panels are then turned into many types of finished products like: to make furniture, cabinets, shelving, countertops, flooring, and moldings in homes. Laminates and coatings on these products can reduce the formaldehyde emissions, which lowers the risk of respiratory irritation and cancer<sup>26</sup>.

Formaldehyde emissions from composite wood furniture may be reduced in classrooms when furniture that needs replacing is upgraded to no-added (NAF) or ultra-low emitting formaldehyde (ULEF) furniture instead of simply replacing it with furniture that meets the Air Toxics Control Measure's Phase 2 emissions standards. Reducing the cumulative exposure burden of formaldehyde emissions for sensitive

populations, such as school children, is especially important to improve human health.

**c) Zero-Emission Lawn and Garden Equipment**

In 1992, CARB adopted regulations to limit the exhaust emissions from Small Off-Road Engines known as SORE. Since this time, SORE have seen the addition of evaporative emission standards as well as updated exhaust standards. In 2018, the California Air Resources Board concluded a preliminary study of exposure from small off-road engines in the lawn and garden sector that focused on operator exposure. The study was intended to estimate operator exposure to air pollutants and noise from gasoline and battery-powered lawn and garden equipment and to analyze the associated health risks. The study showed elevated exposure levels due to the close proximity of the operator to exhaust emissions that would be exacerbated by regular equipment use. These exposure levels are above safe health-based standards and may cause increased cancer risks. This study concluded that transitioning to zero-emission lawn and garden equipment significantly reduces exposure emissions to the operator. Due to the proximity of lawn and garden equipment to sensitive receptors such as school children, staff have included this funding option as a method to reduce cumulative exposure from criteria and toxic air pollutants.

Most commercial lawn and garden equipment are powered by internal combustion engines that are at or under 25 horsepower or 19 kilowatts. The 2018 study also recognizes gasoline-powered lawn and garden equipment to emit a number of criteria and toxic air pollutants. These engines and equipment emit pollutants during use (in-use) and when the equipment is in storage. The in-use component consists of both exhaust and evaporative emissions. The other component is evaporative emissions that occur during equipment storage or through other gasoline handling activities associated with fueling equipment.

The toxics of concern for equipment in this category occur during both in use and in storage. These toxic air contaminants are benzene, toluene, ethylbenzene, xylene, and 1,3-butadiene. Benzene and 1,3-butadiene are known carcinogens with no safe levels of exposure. CARB is currently developing new exhaust standards for manufacturers of lawn and garden equipment. In addition to requiring lower emissions, the regulation is intended to incentivize a market transition within the lawn and garden category, to zero-emission equipment.

## References

1. *Health effects of outdoor air pollution. Committee of the Environmental and Occupational Health Assembly of the American Thoracic Society.* American Journal of Respiratory and Critical Care Medicine, 1996. **153**(1): p. 3-50.
2. Brauer, M., et al., *Air pollution and development of asthma, allergy and infections in a birth cohort.* European Respiratory Journal, 2007. **29**(5): p. 879.
3. Brunekreef, B. and S.T. Holgate, *Air pollution and health.* The Lancet, 2002. **360**(9341): p. 1233-1242.
4. Chen, Z., et al., *Chronic effects of air pollution on respiratory health in Southern California children: findings from the Southern California Children's Health Study.* Journal of thoracic disease, 2015. **7**(1): p. 46-58.
5. Kim, J.-H., et al., *Effects of Air Pollutants on Childhood Asthma.* Yonsei Med J, 2005. **46**(2): p. 239-244.
6. McConnell, R., et al., *Traffic, susceptibility, and childhood asthma.* Environmental health perspectives, 2006. **114**(5): p. 766-772.
7. O'Connor, G.T., et al., *Acute respiratory health effects of air pollution on children with asthma in US inner cities.* Journal of Allergy and Clinical Immunology, 2008. **121**(5): p. 1133-1139.e1.
8. Ostro, B., et al., *Air Pollution and Exacerbation of Asthma in African-American Children in Los Angeles.* Epidemiology, 2001. **12**(2): p. 200-208.
9. Meng, Y.-Y., S.H. Babey, and J. Wolstein, *Asthma-related school absenteeism and school concentration of low-income students in California.* Preventing chronic disease, 2012. **9**: p. E98-E98.
10. Wallace, L., *Indoor particles: A review.* Journal of the Air & Waste Management Association, 1996. **46**(2): p. 98-126.
11. Ozkaynak, H., et al., *Personal exposure to airborne particles and metals: Results from the particle team study in Riverside, California.* Journal of Exposure Analysis and Environmental Epidemiology, 1996. **6**(1): p. 57-78.
12. Ozkaynak H, X.J., Weker R, Butler D, Koutrakis P, and Spengler J, *The Particle TEAM (PTEAM) study: analysis of the data.* 1996, EPA.
13. Brauer, M., et al., *Assessment of indoor fine aerosol contributions from environmental tobacco smoke and cooking with a portable nephelometer.* Journal of Exposure Analysis and Environmental Epidemiology, 2000. **10**(2): p. 136-144.
14. Abt, E., et al., *Relative contribution of outdoor and indoor particle sources to indoor concentrations.* Environmental Science & Technology, 2000. **34**(17): p. 3579-3587.
15. Fortmann, R., Kariher, P, and Clayton, R, *Indoor Air Quality: Residential Cooking Exposures.* 2001: Triangle Park, NC.
16. F.J. Offermann, R.G.S., W.J. Fisk, D.T. Grimsrud, W.W. Nazaroff, A.V. Nero, K.L. Revzan, J. Yater, *Control of respirable particles in indoor air with portable air cleaners.* Atmospheric Environment, 1985. **19**(11): p. 1761-1771.
17. Abraham, M.E., *Microanalysis of indoor aerosols and the impact of a Compact High-Efficiency Particulate air (HEPA) filter system.* Indoor Air-International Journal of Indoor Air Quality and Climate, 1999. **9**(1): p. 33-40.
18. Batterman, S., C. Godwin, and C.R. Jia, *Long duration tests of room air filters in cigarette smokers' homes.* Environmental Science & Technology, 2005. **39**(18): p. 7260-7268.
19. Hacker, D.W. and E.M. Sparrow, *Use of air-cleaning devices to create airborne particle-free spaces intended to alleviate allergic rhinitis and asthma during sleep.* Indoor Air, 2005. **15**(6): p. 420-431.
20. McDonald, E., et al., *Effect of air filtration systems on asthma - A systematic review of randomized trials.* Chest, 2002. **122**(5): p. 1535-1542.

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21. Custovic, A., et al., *Distribution, aerodynamic characteristics, and removal of the major cat allergen Fel d 1 in British homes*. Thorax, 1998. **53**(1): p. 33-38.
22. Burroughs, H.E.B. and K.E. Kinzer, *Improved filtration in residential environments*. Ashrae Journal-American Society of Heating Refrigerating and Air-Conditioning Engineers, 1998. **40**(6): p. 47-51.
23. Macintosh, D.L., et al., *Whole House Particle Removal and Clean Air Delivery Rates for In-Duct and Portable Ventilation Systems*. Journal of the Air & Waste Management Association, 2008. **58**(11): p. 1474-1482.
24. Martenies, S.E. and S.A. Batterman, *Effectiveness of Using Enhanced Filters in Schools and Homes to Reduce Indoor Exposures to PM<sub>2.5</sub> from Outdoor Sources and Subsequent Health Benefits for Children with Asthma*. Environmental Science & Technology, 2018. **52**(18): p. 10767-10776.
25. Bennett, D., *Benefits of High Efficiency Filtration to Children with Asthma*. CARB Research Contract #11-324, 2018.
26. CARB, 2007. Final Rule Airborne Toxic Control Measure to Reduce formaldehyde Emission from Composite Wood Products.